

1     CLAIMS:

2             1.     A method of forming a conductive adhesive connection  
3 comprising:

4             providing a first node;

5             providing a second node;

6             providing a liquid conductive epoxy between the first and second  
7 nodes, the liquid conductive epoxy having sufficient conductivity that  
8 a 15 mil length sample of the liquid conductive epoxy having cross-  
9 sectional dimensions of 50 mil by 2 mil would have a resistance of less  
10 than about 100 ohms along its length while having a viscosity of less  
11 than about 100,000 cps; and

12             curing the liquid conductive epoxy to form a conductive adhesive  
13 connection between the first node and the second node.

1           2.    A method of forming a conductive adhesive connection  
2 comprising:

3           providing a first node;

4           providing a second node;

5           providing a liquid conductive epoxy mixture between the first and  
6 second nodes, the liquid conductive epoxy mixture comprising a first  
7 liquid and a second liquid, the liquid conductive epoxy mixture having  
8 sufficient conductivity that a 15 mil length sample of the liquid  
9 conductive epoxy having cross-sectional dimensions of 50 mil by 2 mil  
10 would have a resistance of less than about 100 ohms along its length  
11 between about 10 minutes and about 20 minutes of combining the first  
12 and second liquids; and

13           curing the liquid conductive epoxy to form a conductive adhesive  
14 connection between the first node and the second node.  
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1           3.    A method of forming a conductive adhesive connection  
2 comprising:

3           providing a first node;

4           providing a second node;

5           providing a liquid conductive epoxy mixture between the first and  
6 second nodes, the liquid conductive epoxy mixture comprising a first  
- liquid and a second liquid, the liquid conductive epoxy mixture having  
8 sufficient conductivity that a 15 mil length sample of the liquid  
9 conductive epoxy having cross-sectional dimensions of 50 mil by 2 mil  
10 would have a resistance of less than about 100 ohms along its length  
11 in less than or equal to about 30 minutes of combining the first and  
12 second liquids; and

13           curing the liquid conductive epoxy to form a conductive adhesive  
14 connection between the first node and the second node.  
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1           4.    A method of forming a conductive adhesive connection  
2 comprising:

3           providing a first node;

4           providing a second node;

5           providing a liquid conductive epoxy mixture between the first and  
6 second nodes, the liquid conductive epoxy mixture comprising a first  
7 liquid and a second liquid, the first liquid comprising a hardener and  
8 the second liquid comprising a base epoxy; the liquid conductive epoxy  
9 mixture comprising at least one ionic salt, the mixture having a  
10 sufficiently high ionic salt concentration that a 15 mil length sample of  
11 the liquid conductive epoxy mixture having cross-sectional dimensions of  
12 50 mil by 2 mil would have a resistance of less than about 100 ohms  
13 along its length in less than or equal to about 30 minutes of combining  
14 the first and second liquids; and

15           curing the liquid conductive epoxy to form a conductive adhesive  
16 connection between the first node and the second node.

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18           5.    The method of claim 4 wherein the liquid epoxy mixture is  
19 formed by combining the first and second liquids with a third liquid,  
20 the third liquid comprising the ionic salt.  
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1           6.    The method of claim 4 wherein the liquid epoxy mixture is  
2   formed by combining the first and second liquids with a third liquid,  
3   the third liquid comprising the ionic salt; and wherein the first, second  
4   and third liquids are mixed prior to providing the liquid conductive  
5   epoxy mixture between the first and second nodes.

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7           7.    The method of claim 4 wherein the first and second liquids  
8   are mixed prior to providing the liquid conductive epoxy mixture  
9   between the first and second nodes.

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11           8.    The method of claim 4 wherein the ionic salt is comprised  
12   by the first liquid before combining the first and second liquids.

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14           9.    The method of claim 4 wherein the ionic salt is comprised  
15   by the second liquid before combining the first and second liquids.

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17           10.   The method of claim 4 wherein the ionic salt is comprised  
18   by the first and second liquids before combining the first and second  
19   liquids.

1 11. The method of claim 4 wherein the ionic salt comprises a  
2 lithium salt.

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4 12. The method of claim 4 wherein the ionic salt comprises a  
5 lithium imide salt.  
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1           13. A method of forming a conductive adhesive connection  
2 comprising:

3           providing a first node;

4           providing a second node;

5           providing a liquid conductive epoxy mixture between the first and  
6 second nodes, the liquid conductive epoxy mixture comprising a first  
7 liquid and a second liquid, the first liquid comprising a hardener and  
8 the second liquid comprising a base epoxy; the liquid conductive epoxy  
9 mixture comprising at least one ionic salt; the ionic salt being present  
10 in sufficient concentration that a 15 mil length sample of the liquid  
11 conductive epoxy mixture having cross-sectional dimensions of 50 mil  
12 by 2 mil would have a resistance of less than about 100 ohms along  
13 its length in less than or equal to about 30 minutes of combining the  
14 first and second liquids while having a viscosity of less than about  
15 100,000 cps; and

16           curing the liquid conductive epoxy to form a conductive adhesive  
17 connection between the first node and the second node.

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19           14. The method of claim 13 wherein the liquid epoxy mixture  
20 is formed by combining the first and second liquids with a third liquid,  
21 the third liquid comprising the ionic salt.  
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1           15. The method of claim 13 wherein the liquid epoxy mixture  
2 is formed by combining the first and second liquids with a third liquid,  
3 the third liquid comprising the ionic salt; and wherein the first, second  
4 and third liquids are mixed prior to providing the liquid conductive  
5 epoxy mixture between the first and second nodes.

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7           16. The method of claim 13 wherein the first and second liquids  
8 are mixed prior to providing the liquid conductive epoxy mixture  
9 between the first and second nodes.

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11           17. The method of claim 13 wherein the ionic salt is comprised  
12 by the first liquid before combining the first and second liquids.

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14           18. The method of claim 13 wherein the ionic salt is comprised  
15 by the second liquid before combining the first and second liquids.

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17           19. The method of claim 13 wherein the ionic salt is comprised  
18 by the first and second liquids before combining the first and second  
19 liquids.



1           20. The method of claim 13 wherein the ionic salt comprises  
2 a lithium salt.

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4           21. The method of claim 13 wherein the ionic salt comprises  
5 a lithium imide salt.

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7           22. A method of forming a conductive adhesive connection  
8 comprising:

9           providing a first node;

10          providing a second node;

11          providing a liquid conductive epoxy mixture between the first and  
12 second nodes, the liquid conductive epoxy mixture comprising a first  
13 liquid and a second liquid, the first liquid comprising a hardener and  
14 the second liquid comprising a base epoxy; the liquid conductive epoxy  
15 mixture comprising at least one ionic salt; the ionic salt being present  
16 in sufficient concentration that a 15 mil length sample of the liquid  
17 conductive epoxy mixture having cross-sectional dimensions of 50 mil  
18 by 2 mil would have a resistance of less than about 100 ohms along  
19 its length while having a viscosity of less than about 100,000 cps; and

20          curing the liquid conductive epoxy to form a conductive adhesive  
21 connection between the first node and the second node.

1           23. A method of forming a conductive adhesive connection  
2 comprising:

3           providing a first node;

4           providing a second node;

5           providing a liquid conductive epoxy mixture between the first and  
6 second nodes, the liquid conductive epoxy mixture comprising a first  
7 liquid and a second liquid, the first liquid comprising a hardener and  
8 the second liquid comprising a base epoxy; the liquid conductive epoxy  
9 mixture comprising an ionic salt; and

10           curing the liquid conductive epoxy to form a conductive adhesive  
11 connection between the first node and the second node.

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13           24. The method of claim 23 wherein the liquid epoxy mixture  
14 is formed by combining the first and second liquids with a third liquid,  
15 the third liquid comprising the ionic salt.

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17           25. The method of claim 24 wherein the ionic salt is completely  
18 dissolved in the third liquid prior to combining the third liquid with the  
19 first and second liquids.  
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1           26. The method of claim 23 wherein the liquid epoxy mixture  
2 is formed by combining the first and second liquids with a third liquid,  
3 the third liquid comprising a thinner selected from the group consisting  
4 of aliphatic glycidyl ethers and aromatic glycidyl ethers, the ionic salt  
5 being a lithium salt present in the third liquid to a concentration of  
6 from about 0.5 molar to about 1.2 molar prior to combining the third  
- liquid with the first and second liquids.

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9           27. The method of claim 23 wherein the ionic salt comprises  
10 a lithium imide salt.

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12           28. The method of claim 23 wherein the ionic salt comprises  
13 one or more salts selected from the group consisting of  $\text{LiAsF}_6$  and  
14  $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ .

1           29. A method of forming a conductive adhesive connection  
2 comprising:

3           providing a substrate, the substrate having a first node location  
4 and a second node location, the first and second node locations being  
5 joined by an electrical interconnect;

6           providing a first component having a first node;

7           providing a second component having a second node;

8           providing a liquid conductive epoxy between the first node and  
9 the first node location, the liquid conductive epoxy comprising a first  
10 liquid and a second liquid, the first liquid comprising a hardener and  
11 the second liquid comprising a base epoxy; the liquid conductive epoxy  
12 comprising a lithium salt;

13           providing the liquid conductive epoxy between the second node  
14 and the second node location; and

15           curing the liquid conductive epoxy to form a circuit comprising the  
16 first component electrically connected to the second component.  
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1 30. A method of forming a circuit comprising:  
2 providing a substrate, the substrate having a first node location  
3 and a second node location, the first and second node locations being  
4 joined by an electrical interconnect;  
5 providing a first component, the first component having a first  
6 node;  
7 providing a second component, the second component having a  
8 second node;  
9 providing a liquid conductive epoxy between the first node and  
10 the first node location, the liquid conductive epoxy having sufficient  
11 conductivity that a 15 mil length sample of the liquid conductive epoxy  
12 having cross-sectional dimensions of 50 mil by 2 mil would have a  
13 resistance of less than about 100 ohms along its length while having a  
14 viscosity of less than about 100,000 cps;  
15 providing the liquid conductive epoxy between the second node  
16 and the second node location; and  
17 curing the liquid conductive epoxy to form a circuit comprising the  
18 first component electrically connected to the second component.  
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1           31. A method of forming a circuit comprising:  
2           providing a substrate, the substrate having a first node location  
3           and a second node location, the first and second node locations being  
4           joined by an electrical interconnect;  
5           providing a first component, the first component having a first  
6           node;  
7           providing a second component, the second component having a  
8           second node;  
9           providing a liquid conductive epoxy mixture between the first node  
10          and the first node location, the liquid conductive epoxy mixture  
11          comprising a first liquid and a second liquid, the first liquid comprising  
12          a hardener and the second liquid comprising a base epoxy; the liquid  
13          conductive epoxy mixture comprising at least one ionic salt, the mixture  
14          having a sufficiently high ionic salt concentration that a 15 mil length  
15          sample of the liquid conductive epoxy mixture having cross-sectional  
16          dimensions of 50 mil by 2 mil would have a resistance of less than  
17          about 100 ohms along its length in less than or equal to about 30  
18          minutes of combining the first and second liquids;  
19          providing the liquid conductive epoxy mixture between the second  
20          node and the second node location; and  
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1 curing the liquid conductive epoxy to form a circuit comprising the  
2 first component electrically connected to the second component.  
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4 32. The method of claim 31 wherein one of the first and  
5 second components is a battery and the other of the first and second  
6 components is an integrated chip.  
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8 33. An epoxy comprising:

9 a liquid mixture of a hardener and a base epoxy; and

10 a concentration of an ionic salt within the liquid mixture, the  
11 concentration of the ionic salt being high enough that a 15 mil length  
12 sample of the liquid mixture having cross-sectional dimensions of 50 mil  
13 by 2 mil would have a resistance of less than about 100 ohms along  
14 its length in less than or equal to about 30 minutes of forming the  
15 liquid mixture.  
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1           34. An epoxy comprising:  
2           a liquid mixture of a hardener and a base epoxy; and  
3           a concentration of ionic salt within the mixture, the concentration  
4 of ionic salt being high enough that a 15 mil length sample of the  
5 liquid mixture having cross-sectional dimensions of 50 mil by 2 mil and  
6 a viscosity of less than 100,000 cps would have a resistance of less than  
- about 100 ohms along its length.

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9           35. An epoxy comprising a lithium salt.

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11           36. The epoxy of claim 35 wherein a 15 mil length sample of  
12 the epoxy having cross-sectional dimensions of 50 mil by 2 mil has a  
13 resistance of less than about 100 ohms along its length.

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15           37. An epoxy comprising:  
16           a liquid mixture of a hardener and a base epoxy; and  
17           a concentration of a lithium salt within the liquid mixture.

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19           38. The epoxy of claim 37 wherein the lithium salt comprises  
20 lithium imide salt.



1           39. The epoxy of claim 37 wherein the lithium salt comprises  
2 one or more salts selected from the group consisting of  $\text{LiAsF}_6$  and  
3  $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ .

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5           40. An epoxy system comprising:  
6 a first liquid comprising a hardener;  
7 a second liquid comprising a base epoxy; and  
8 a third liquid comprising a concentration of a lithium salt, the  
9 first, second and third liquids being configured to be mixed together to  
10 form a liquid epoxy which will cure to form a conductive adhesive  
11 bond.

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13           41. The epoxy system of claim 40 wherein the lithium salt  
14 comprises lithium imide salt.

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16           42. The epoxy system of claim 40 wherein the lithium salt  
17 comprises one or more salts selected from the group consisting of  
18  $\text{LiAsF}_6$  and  $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ .

1           43. The epoxy system of claim 40 wherein the third liquid  
2 comprises a thinner selected from the group consisting of aliphatic  
3 glycidyl ethers and aromatic glycidyl ethers, the lithium salt being  
4 present in the third liquid to a concentration of from about 0.5 molar  
5 to about 1.2 molar.  
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7           44. An epoxy comprising:

8           a liquid mixture of a hardener and a base epoxy; and

9           a concentration of ionic salt within the mixture, the concentration  
10 of ionic salt being high enough that a 15 mil length sample of the  
11 liquid mixture having cross-sectional dimensions of .50 mil by 2 mil and  
12 a viscosity of less than 100,000 cps would have a resistance of less than  
13 about 100 ohms along its length in less than or equal to about 30  
14 minutes of forming the liquid mixture.  
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